

REMARKS

Claims 21, 24-28 and 41-49 are pending in the application. Claims 21 and 41 have been amended, and Claims 50-54 have been added, leaving Claims 21, 24-28, and 41-54 for consideration upon entry of the present amendment.

Support for the amendments to Claims 21 and 41 can be found in the Specification on Page 14, lines 17-19.

Support for new claims 50-54 can be found in originally filed claims 1-3 and 9-10.

Reconsideration and allowance of the claims is respectfully requested in view of the foregoing amendments and the following remarks.

1. Claim Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 21, 24-28 and 41-49 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner alleges that "applicant has stated that a protective coating such as elemental sulfur is necessary to produce the claimed product, and this statement indicates that the invention is different from what is defined in the claims because the claims do not require the protective coating" (Paper 24, Page 2).

Because of the foregoing statement, Applicants believe that the Examiner has misunderstood the invention and thus will clarify. It was recognized by the applicants that the decomposition temperature of active materials such as pyrite is less than the flame temperature of thermal spray. "In order to prevent decomposition, several tests were conducted in which a protective barrier coating, elemental sulfur, was blended with the pyrite and then ball milled before injection into the plasma" (Page 9, lines 5-7). From this statement, it is clear that the protective coating is formed on the feedstock material. The sulfur coating protects the pyrite (i.e., the active material) from decomposition during deposition allowing the deposition of the desired pyrite active material. It is clear to one of ordinary skill in the art that the sulfur is vaporized during deposition (i.e., the boiling point of

sulfur is 445°C) such that the final coating comprises the pyrite (see, for example, Page 14, lines 17-19). Thus, while elemental sulfur is necessary to form the claimed product, it is not present at any detectable level in the active material layer that is presently claimed. For at least the reasons, Applicants submit that the claims correspond in scope to the present invention. Accordingly, reconsideration of the rejection under 35 U.S.C. § 103(a) and allowance of the claims is requested.

2. Claim Rejections Under 35 U.S.C. §102(b)

Claims 21, 24-28 and 41-49 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,716,422 to Muffoletto et al. (hereinafter "Muffoletto").

Present independent Claim 21 is directed to an electrode for an energy storage and conversion device, comprising a substrate and a layer of an active material comprising a metal sulfide, metal selenide, or metal telluride, and having a thickness in the range from about 5 to about 114 microns deposited on the substrate, wherein the layer comprises greater than 95% of the active material. Independent Claim 41 further defines the active material as comprising FeS₂, CoS₂, WS₂, NiS₂, MoS₂, metal selenide, or metal telluride. Independent Claim 45, in contrast, is a product by process claim where the electrode has a layer of an active material having a thickness in the range from about 5 to about 114 microns comprising a metal sulfide, metal selenide, or metal telluride deposited on the substrate by a thermal spray method comprising providing a feedstock mixture comprising an effective quantity of a source of elemental sulfur and a metal sulfide, an effective quantity of a source of elemental selenium and a metal selenide, or an effective quantity of a source of elemental tellurium and a metal telluride and thermally spraying the feedstock mixture onto the substrate.

Muffoletto discloses an electrochemical cell having a cathode comprising a substrate and a cathode active material provided by a thermal spray deposited layer with a thickness of about 0.001 inches (25.4 microns) to about 0.4 inches (10,000 microns) (Claim 1).

Muffoletto teaches that the material suitable for thermal spray to produce the thermal spray deposited layer referred to above is selected from the group consisting of silver vanadium oxide, copper silver vanadium oxide, manganese dioxide, titanium disulfide, copper oxide,

chromium oxide, copper sulfide, iron sulfide, iron disulfide, cobalt oxide, nickel oxide, carbon and fluorinated carbon and mixtures thereof (Column 6, lines 1-5). In disclosing the thermal spray of these materials, Muffoletto does not teach or suggest any precautions or additional steps to protect the active material being sprayed from decomposition.

Applicants previously argued that Muffoletto does not provide an enabling disclosure for an electrode containing a metal sulfide, a metal selenide or a metal telluride by thermal spray. As evidence, Applicants submitted a Declaration by Dr. Xiao which shows that when pyrite is sprayed in the process of Muffoletto, the product is primarily Fe₂O₃ and not pyrite. In response, the Examiner alleges that while the Fe₂O₃ may be produced "some pyrite is formed and this amount would meet the claimed subject matter" (Paper 24, Page 3).

To better define the invention, Applicants have amended independent Claims 21 and 41 to recite the limitation "wherein a primary phase of the layer comprises greater than 95% of the active material". This limitation clearly distinguishes the present invention over the compositions of Muffoletto which do not fulfill the limitation "wherein a primary phase of the layer comprises greater than 95% of the active material".

To anticipate a claim under 35 U.S.C. § 102, a single source must contain all of the elements of the claim. *Lewmar Marine Inc. v. Barient, Inc.*, 827 F.2d 744, 747, 3 U.S.P.Q.2d 1766, 1768 (Fed. Cir. 1987), *cert. denied*, 484 U.S. 1007 (1988). Moreover, the single source must disclose all of the claimed elements "arranged as in the claim." *Structural Rubber Prods. Co. v. Park Rubber Co.*, 749 F.2d 707, 716, 223 U.S.P.Q. 1264, 1271 (Fed. Cir. 1984).

While Muffoletto discloses the use of FeS₂, it does not disclose that a primary phase of the layer containing the active material contains greater than 95% of the active material. In fact, as shown in the inventor's Rule 1.132 Declaration, an FeS₂ layer deposited as taught in Muffoletto would be primarily Fe₂O₃, not FeS₂. Thus, Muffoletto does not disclose an FeS₂ layer as claimed in the present application.

Applicants further submit that Muffoletto does not render the present claims obvious because for an obviousness rejection to be proper, the Examiner must meet the burden of establishing a prima facie case of obviousness. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed.

Cir. 1988). Establishing a prima facie case of obviousness requires that all elements of the invention be disclosed in the prior art. *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970).

Because Muffoletto does not disclose a layer wherein a primary phase of the layer comprises greater than 95% of the active material, Muffoletto also cannot render the resent claims obvious.

Regarding independent Claim 45, this claim is essentially a product by process claim in which the electrode has a layer of an active material having a thickness in the range from about 5 to about 114 microns comprising a metal sulfide, metal selenide, or metal telluride deposited on the substrate by a thermal spray method comprising providing a feedstock mixture comprising an effective quantity of a source of elemental sulfur and a metal sulfide, an effective quantity of a source of elemental selenium and a metal selenide, or an effective quantity of a source of elemental tellurium and a metal telluride and thermally spraying the feedstock mixture onto the substrate. Muffoletto does not teach a feedstock comprising a source of elemental sulfur and a metal sulfide, a source of elemental selenium and a metal selenide, or a source of elemental telluride and a metal tellurium. Because Muffoletto is missing these elements of Claim 45, it cannot anticipate or render obvious independent Claim 45 and the claims that depend therefrom.

For at least the foregoing reasons, reconsideration and withdrawal of the rejection under 35 U.S.C. § 102(b) is requested.

3. Claim Rejections Under 35 U.S.C. §103(a)

Claims 21, 28, 41, 45, and 49 are further rejected under 35 U.S.C. §103(a) as obvious over Muffoletto in view of U.S. Patent No. 3,907,589 to Gay et al. (hereinafter "Gay")

Gay teaches an electrochemical cell in which the cathodes comprises a transition metal sulfide such as FeS_2 (Abstract). The particle sizes of the pyrite are 15 nanometers to 200 nanometers (Column 5, lines 54-56).

In making the rejection, the Examiner states "To utilize the teachings of Muffoletto the 15 nanometer particle size of Gay would have been obvious to one of ordinary skill in this art" (Paper 24, Page 4).

As explained in detail above, Muffoletto neither anticipates nor renders obvious the present claims. In addition, applicants note that Claims 21, 41 and 45 do not require nanometer-sized particles. Claims 28 and 48, and also 44, which is not mentioned in the rejection, require a nanostructured material. Gay does not cure the defects of Muffoletto regarding independent Claims 21, 41 and 45 as it does not supply the element of the percentage of active material in the layer. Further, as dependent claims of allowable independent claims, Claims 28, 48 and 44 are also allowable over the combination of Muffoletto and Gay. For at least these reasons, reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a) are requested.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance is requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by the Applicants' Attorney.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Marked-up versions of Claims 21 and 41 follow:

21. (Twice Amended/Marked-Up) An electrode for an energy storage and conversion device, comprising

a substrate; and

a layer of an active material comprising a metal sulfide, metal selenide, or metal telluride, and having a thickness in the range from about 5 to about 114 microns deposited on the substrate, wherein the layer comprises greater than 95% of the active material~~the active material decomposes or transforms at thermal spray temperatures to a material unsuitable for use in an electrode.~~

41. (Amended/Marked-Up) An electrode for an energy storage and conversion device, comprising

a substrate; and

a layer of an active material comprising FeS_2 , CoS_2 , WS_2 , NiS_2 , MoS_2 , metal selenide, or metal telluride, and having a thickness in the range from about 5 to about 114 microns deposited on the substrate, wherein the layer comprises greater than 95% of the active material~~the active material decomposes or transforms at thermal spray temperatures to a material unsuitable for use in an electrode.~~